Claims

What is claimed is:

1. A method of treating vascular tissue, the method comprising:

a. locating a target area of the vascular tissue; and

b. delivering laser radiation to the target area, the laser radiation comprising a sequence of laser bursts, wherein each laser burst comprises a plurality of laser pulses having laser fluences sufficient to cut the vascular tissue while controlling hemorrhaging.

2. The method of claim 1, wherein the laser bursts are repeated at a repetition rate of 5.0 KHz or less.

3. The method of claim 1, wherein the repetition rate is in a range of 10 to 40 Hz.

4. The method of claim 1, wherein the laser fluences are in a range of 1.0 to10 J/cm^2.

5. The method of claim 1, wherein the laser fluences are in a range of 2.0 to 7.0 J/cm^2.

6. The method of claim 1, wherein laser bursts comprises 1-24 pulses.

7. The method of claim 6, wherein the laser pulses are separated by less than 2.0 milliseconds.

8. The method of claim 7, wherein the laser pulses are separated by a 0.01 and 1.25 milliseconds.

9. The method of claims 8, wherein the laser pulses have pulse widths of less than 100 microseconds.

10. The method of claim 9, wherein the laser pulses have pulse widths in a range of 65 to 95 microseconds.

11. The method of claim 1, wherein the laser radiation is delivered to the target area with exposure spot sizes of less than 500 microns.

12. The method of claim 11, wherein the exposures spots sizes are in a range of 50 to 225 microns.

13. The method of claim 12, wherein the laser radiation has a penetration depth through aqueous saline medium of less than 1.5 mm.

14. The method of claim 13, wherein the ratio of the exposure spot sizes to the penetration depth is less than 10.

15. The method of claim 1, wherein the laser radiation comprises laser radiation having a wavelength of 2.94 microns and with an energy in a range of 5-200 mJ per bursts.

16. The method of claim 1, wherein the vascular tissue corresponds vascular ophthalmic tissue.

17. The method of claim 16, where locating the target tissue comprises:

a. determining a relative separation between a fibrous membrane or a fibro-vascular membrane and a retinal surface; and

b. selecting a approach angle for cutting the fibrous vascular tissue such that the laser radiation does not significantly penetrate the retinal tissue at the retinal surface.

18. The method of claim 17, wherein the laser radiation is delivered to the ophthalmic tissue at a controlled distance from the retinal surface.

19. A laser system comprising:

a. a laser source for generating laser light comprising laser bursts comprising laser pulses; and

b. a laser applicator for delivering a portion of the laser light to vascular tissue, such that the laser light cuts the vascular tissue without causing significant hemorrhaging.

20. The system of claim 19, wherein the laser source is configured to generate laser light with energy corresponding to between 1 and 200 mJ/per pulse.

21. The system of claim 19, wherein the laser source is configured to generate the laser bursts with a repetition rate of between 40 and 10 Hz.

22. The system of claim 19, wherein the laser source is configured to generate the laser bursts with a separation of less than 2.0 milliseconds.

23. The system of claim 19, wherein the laser burst comprises 1-24 laser pulses.

24. The system of claim 22, the laser pulses are separated by less than 2.0 milliseconds.

25. The system of claim 23, wherein pulses have pulse widths of less than 100 microseconds.

26. The system of claim 18, wherein the laser applicator comprises a flexible optical fiber with a firing end having a diameter of less than 500 microns.

27. The system of claim 26; wherein the optical fiber is selected from the group consisting of fused silica fiber and a sapphire fiber.

28. The system of claim 26, wherein the applicator further comprises structure for shielding unwanted laser light from the vascular tissue.

29. The system of claim 26, wherein the applicator further comprises means to control a distance of the firing end from the vascular tissue.

30. The system of claim 29, wherein the means to control the distance of the firing end from the vascular tissue is a shroud structure.

31. The system of claim 19, wherein applicator is flexible allowing the laser light to be delivered to the vascular tissue at a range of approach angles.

32. A laser system comprising:

a. means to generate bursts of laser light comprising laser pulses;

b. means to focus the laser light into a trunk optical fiber; and

c. flexible endo-probe coupled to the trunk optical fiber, the endo-probe comprises a delivery optical fiber with an input end for receiving laser radiation from the truck fiber and a firing end for exposing a target area of vascular tissue, wherein the target area of vascular tissue is located within the cavity of a body.

33. The laser system of claim 32, wherein the flexible endo-probe comprises guide structures through which the delivery fiber extends, wherein guide structure is configured be bent and to guide the firing edge of the delivery optical fiber at preferred angles relative to the target area of the vascular tissue.

34. The laser system of claim 32, wherein input end of the delivery optical fiber has a diameter of less than 500 microns.

35. The laser system of claim 33, wherein the firing end of the delivery optical fiber has a diameter of 300 micron or less.

36. The laser system of claim 32, wherein the firing end of the delivery optical fiber has a diameter in a range of 50 to 225 micron.

37. The laser system of claim 32, wherein the guide structure is a tubular housing structure that is bent at an angle between 0 to 90 degrees.

38. The laser system of claim 32, wherein the delivery optical fiber is a side firing optical fiber.

39. The laser system of claim 32, wherein the guide structure further comprises a shield member extending in front of a portion the firing end of the delivery optical fiber for blocking laser light emitted from the firing end at angles other than the preferred angles.

40. The laser system of claim 39, wherein the means to generate bursts of laser light comprises an Er:YAG laser medium.

41. The laser system of claim 32, wherein means to generate bursts of laser light is configured to provide between 5 and 200 mJ/per pulse.

42. The laser system of claim 32, wherein the means to generate bursts of laser light is configured to generate laser pulse with a repetition rate between 40 and 10 Hz.

43. The laser system of claim 32, wherein the means to generate bursts of laser light is

configured to generate a burst of laser light that are separations of less than 2.0 milliseconds.

44. The laser system of claim 32, wherein the means to generate bursts of laser light is configured to generate 1-20 laser pulses for each laser burst.

45. The laser system of claim 44, wherein means to generate bursts of laser light is configured to generate the laser pulses at pulse separations of less than 2.0 milliseconds.

46. The laser system of claim 32, wherein the delivery optical fiber is selected from the group consisting of a fused silica fiber and sapphire fiber.

47. The laser system of claim 32, wherein the trunk fiber is a sapphire optical fiber.